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Is post-disaster housing reconstruction with participatory method effective to increasing people's awareness for disaster prevention?

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Abstract

After the Indian Ocean Tsunami in 2004, many organizations supported housing construction in disaster affected areas. Several documents and papers reported that adopting the community participation in the post disaster situation is effective because disaster affected people needed skills to get a job to increase their income. Many organizations adopted the participatory method in their recovery program especially in housing construction because it would increase people's awareness to the natural disasters and develop their capacity through the working processes.
This research aims to evaluate the long-term changes between level of people's participation in post-disaster housing construction and current level of awareness for the natural disaster. Questionnaire survey was conducted in three areas which were affected by tsunami (Ache) and earthquake (Yogyakarta and Padang) in Indonesia. Ache was devastated by Indian Ocean Tsunami in 2004, about 31,000 people were killed in the capital of Banda Ache alone. Yogyakarta was hit by earthquake in 2006, and over 5,000 people were killed and 95% housing was collapsed in the community located near the epicenter. Padang was affected by earthquake in 2009, and 1,100 people were reported to be killed or missing. Total of 504 samples were collected (Ache 170, Yogyakarta 155 and Padang 179), we have compared three areas to understand the relationship with 'participation' and 'awareness'. This research findings will be useful to the housing reconstruction planning such as how to increase people's awareness and how we can approach to people's action for the future. We believe the possibility of participatory method for recovery phase, but long-term evaluation will reveal undiscussed issues, and it will give us a hint to improve more effective support for the people.

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1. Introduction

In recent years, housing reconstruction after disaster has adopted the participatory method by various organizations. Comerio stated that self-help housing is now the current model for rebuilding after disasters in developing countries [1]. Community participation in the post-disaster situation is effective because it will support to increase their income, get some skills of construction, and increase people's awareness to the natural disasters through the working processes. This study will show that relationship between 'participation to the reconstruction' and 'awareness to the natural disaster' based on the result of questionnaire survey. In particular it focuses on long-term evaluation. We studied the recovery process of three different sites where experienced a disaster some years ago. Our study areas are heavily damaged areas because of tsunami and earthquake in 2004 (Ache), earthquake in 2006 (Yogyakarta) and earthquake in 2009 (Padang). It has passed about 7 years to 12 years.

On 26th December 2004, a strong earthquake of magnitude 9.1 on the richer scale occurred in the Northwest of Sumatra Island, Indonesia caused the Indian Ocean Tsunami. City of Banda Aceh is closest to the epicentre where nearly 130,000 deaths, 500,000 homeless and extensive damage to life, property and infrastructures occurred [2]. According to the assessment carried out by the ministry of public works in May 2005, 116,900 houses were destroyed and 14,200 houses were heavily damaged in Aceh province [2] [3].

On 27th May 2006, a magnitude 6.3 earthquake struck the island Java, Indonesia. More than 5,000 people were killed and over 4,000 people got injured, and 600,000 people lost their permanent shelter. As estimated, 154,000 houses were completely destroyed and 260,000 suffered some levels of damage. Most heavily affected area was the Bantul district in Yogyakarta Special Province, and the Klaten district in Central Java Province [4].

On 30th September 2009, a magnitude 7.6 earthquake struck Western Sumatra coast in Indonesia. The second earthquake with magnitude 6.2 occurred 22 minutes later, and the third one with magnitude 6.8 struck an island area at next early morning. As estimated, 739 people were killed, with another 296 people missing and presumed dead. Primarily in Padang Pariaman district, more than 121,000 homes were severely damaged then 52,000 houses were moderately damaged [5].

In all cases, housing reconstruction were conducted in collaboration with community members. In previous studies, scholars and aid organizations supported the concept of community participation in post-disaster housing project [6] [7] [8] [9] [10]. In this study, we pay special attention when we consider the participation for reconstruction process or reconstruction work, or both. All cases took place around 10 years ago. The purpose of this study is to evaluate effectiveness of participatory method for housing reconstruction and improvement of disaster awareness of participants after 10 years for achieving 'build back better' in post reconstruction program.

2. Participatory Approach for Housing Reconstruction after Natural Disaster

Post-disaster housing reconstruction is extensively studied in which issues of people's participation, ownership, and accountability [11] [12] [13]. Maskrey [14] finds that, "people were able, through community-based organizations (CBOs), to articulate strategies for recovery and reconstruction which responded to their real needs". And now many organizations adopted the participatory method in their recovery program because it based on lessons from past recovery cases. These bottom-up approaches called participatory method/approach or owner-driven approaches have been advocated till this day [15] [16] [17]. When the owner is given more control over the housing reconstruction, it is possible to have a higher level of satisfaction as well as a higher chance to restore a sense of pride and to integrate their indigenous ways of building [18]. However, on the other hands, it has some of issue also. Souheil El-Masri [19] mentioned that reconstruction efforts after a disaster have been criticized as a failure of conventional top-down approaches that concentrated their attention on speed, standardization and technological oriented solutions. The idea of community participation has been so widely expressed that it does not seem to mean anything clear anymore [6]. And there are many issues like speed, quality, and management are critical to the post disaster reconstruction. More importantly, how people adopted to their newly built environment is crucial for the overall sustainability of their life [9].

For considering about participation to housing reconstruction, Davidson et al. [6] combined Arnstein's theory of a "ladder of community participation" [20], and Choguill [21] revised the modified theory to fit in the context of post-disaster housing reconstruction. The ladder consists of five levels from 'no control' to 'control'; manipulate, inform, consult, collaborate and empower.

In the disaster recovery phase, participation was surmised that it is a key factor in the success or failure of post-disaster resettlement [22] as well as affecting the equity, long-term sustainability, and resiliency of affected communities [14] [23]. Tsunami Global Lessons Learned Project Steering Committee (TGLLP-SC) [24] mentioned key activities about post-disaster housing reconstruction. It stated that, "community participation in housing recovery shows one of key activity in implementation of housing recovery program". In addition, UNDP [10] mentioned about guiding principle for post-disaster recovery, and they suggest to govern by principles. One of principle is "Identify need and priorities of affected populations by creating participatory processes that involve communities themselves in decision-making, service delivery and recovery".

3. Housing Reconstruction after Natural Disaster in Indonesia

3.1. Recovery support for housing reconstruction

Between 2004 and 2010, Indonesia was struck by several devastating natural disasters. Especially the biggest one was Sumatra Earthquake and Indian Ocean Tsunami in December 26th, 2004. It caused heavy damage to the population in the coastal area. After that a massive earthquake happened close to the island of Nias in March 2005. In May 2006, Yogyakarta and the province of Central Java were struck by a big earthquake, and in July 2006 again earthquake happened and a tsunami hit the south coast of West Java. The Government of Indonesia and development partners agreed that a community-based method would be used for rebuilding houses and community infrastructure, first in Aceh and later in Java [25]. In case of Aceh, the adaptation of the participatory method into their reconstruction efforts was suggested by the government and donor agencies from the start. Many people benefitted from the participatory method by increasing their ties to the communities and involving themselves in the rebuilding processes of their own houses [9].

Government of Indonesia boldly recognized the benefits and risks of the community based method, and they applied, fine-tuned and adapted it over the course of the past seven years, and finally set Rekompak which was created and adapted through the Multi Donor Fund for Aceh and Nias (MDF) and the Java Reconstruction Fund (JRF) between 2005 and 2012 in considered a keystone of its national program for post-disaster reconstruction of settlements. Policy-makers and others facing decisions on post-disaster housing reconstruction will consider applying the Rekompak approach which has been so successful in rebuilding communities and lives after disasters in Indonesia [25].

After West Sumatra's earthquake in 2009, through the National Agency for Disaster Management (BNPB), the central government has formed a rehabilitation and reconstruction Technical Support Team (TPT-PP) to assist the Governor of West Sumatra in implementing rehabilitation and reconstruction [26].

3.2. How was 'participatory method' in these areas?

In these target areas, people could join the reconstruction processes. Aid organizations prepared some activities for housing reconstruction, and people had a chance to join the program. To understand the levels of people's participation, there are 13 items in questionnaire, and responders are asked to answer them by multiple choice. These 13 items are; reconstruction consultation, selection of housing reconstruction committee, selection of housing group, community assessment, land consolidation, community planning, house design, purchasing materials, technical training, construction of house, quality control, others, and none. In this study, we evaluated them by putting weight on numbers of participation for these reconstruction processes of own house.

4. Methods

The following sections are based on field surveys that have been carried out between 2015 and 2016. For understanding the relation with 'participation' and 'awareness', we conducted questionnaire survey in three areas

where were affected by natural disaster in 2004, 2006 and 2009 where housing reconstruction was conducted by adopting the participatory method by government or aid organizations (Fig.1).

Surveyors visited each house and the residents were asked to answer the questionnaire face to face. Questionnaire was translated into Indonesian, and local university students conducted the survey. Before conducting the survey, we conducted a briefing to students for explaining the meaning of the questions, how to explain, and so on, and this briefing took about 60-90 minutes. We decided to target about 30% of total households to be surveyed in each community, and target houses was selected by random sample means that we took sampling based on the availability of household at the site.

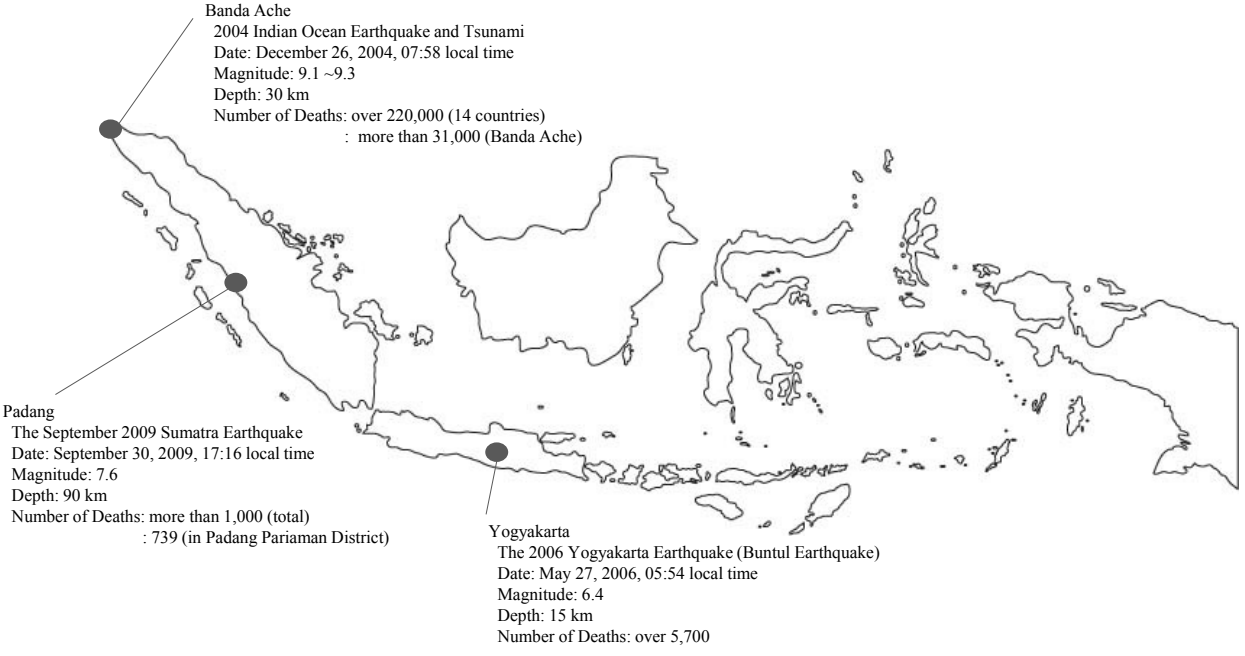

Fig. 1. Location and information of affected by natural disasters in survey areas, Indonesia

In three areas, we selected two communities for each area to collect samples (Table 1). Questionnaire consisted 7 categories; background of respondent, details of house, extension and renovation of the house, awareness on disaster, trust/relationship, life/living satisfaction and technical knowledge, and a total of 34 questions. On average, it took approximately 30 mins to complete one questionnaire.

In this paper, we show that participatory method for housing reconstruction has a positive effect in increasing disaster risk awareness, relation with years of residence and relation with satisfaction level of reconstructed house. For data analysis, we made indicators; first, indicator for the participation level, we defined based on total items of participation for reconstruction process in Table 2. For example, how many items one respondent participated in the process. If he/she participated in ‘Housing design’, ‘Technical training’ and ‘Construction of house’, it means “more participation” (>=2), and if he/she joined only one item like ‘Quality control’ or ‘community assessment’ means “less participation” (<2). Second, indicator for disaster risk awareness, we defined it based on whether people are prepared for next disaster now. In the questionnaire, people could choose from 7 items such as; ‘Add strength by repairing pillar and wall’, ‘Preparing emergency kit’, ‘Prepare valuables/important documents’, ‘Know where to evacuate’, ‘Know how to protect myself from falling objects, and ‘Others,. It was multiple choice answers, and we checked how many people did not check ‘No’. We categorized the results as those who checked over 2 (>=2) or less than 2 (<2). Third, indicator for years of residence, we used 4 categories such as; ‘less than 1 year’, ‘1 to 5 years’, ‘6 to 9 years’ and ‘over 10 years’, and calculated the mean. Results was categorized into 2 (categories) less than 1 year or 1 to 5 years (<5years) and 6 to 9 years or over 10 years (>=5years). Fourth, indicator for satisfaction level of reconstructed house, we used a question of ‘Are you satisfied with your reconstructed house?’, then respondent could choose either ‘Yes’ or ‘No’.

'Yes' means they are satisfied with their reconstructed house, but if it was 'No' it means they are unsatisfied with reconstructed house. We calculated the mean and used for data analyze.

Total collected sample is 504 (Ache 170, Yogyakarta 155 and Padang 179) and valid response is 493. These data were analysed by IBM SPSS Statistics for analysis of variance and t-test.

Table 1. Target communities and the collected sample size

Area	Ache		Yogyakarta		Padang	
Community name	GP Pande	Lambung	Klaten district (Mlese)	Bantul district (Serut)	Pasir Jambak	Limpato
No. of household	251	223	200	225 (RT4 to RT8)*	270	240
Aid organizations	ADB Government NGOs	MDF(WB) Government	JRF Government	JRF Government	NGOs Government	Government
Collected samples	77	93	72	83	86	93
Valid response	77	93	72	83	86	82

*RT is the smallest community administration. There are RT1 to RT 9 in Serut, our target community was RT4 to RT8. The selection was depended on the levels of damage (affected/non-affected) by earthquake.

Table 2. Participation for housing reconstruction

	Ache		Yogyakarta		Padang		Total (n=493)
	GP Pande (n=77)	Lambung (n=93)	Mlese (n=72)	Serut (n=83)	Pasir Jambak (n=86)	Limpato (n=82)	
Constructed based on aid agency	63 (82%)	54 (58%)	3 (4%)	4 (5%)	1 (1%)	1 (1%)	126 (25.6%)
Worked together with the facilitator	4 (5%)	3 (3%)	4 (6%)	14 (17%)	4 (5%)	1 (1%)	30 (6.1%)
Participated in the training	3 (4%)	0 (0%)	12 (17%)	13 (16%)	17 (20%)	5 (6%)	50 (10.1%)
Received a guideline booklet	1 (1%)	2 (2%)	14 (19%)	13 (16%)	14 (16%)	6 (7%)	50 (10.1%)
Employed donor-designated-mason	2 (3%)	0 (0%)	1 (1%)	3 (4%)	1 (1%)	0 (0%)	7 (1.4%)
Appointed mason by myself	0 (0%)	15 (16%)	49 (68%)	60 (72%)	67 (78%)	75 (91%)	266 (54%)
Constructed the house by myself	2 (3%)	2 (2%)	48 (67%)	40 (48%)	55 (64%)	47 (57%)	194 (39.4%)
Renting	7 (9%)	21 (23%)	0 (0%)	0 (0%)	0 (05)	0 (0%)	28 (5.7%)

Percentage (%) is calculated by dividing answers of each category by total sample collected in each village (n). For example, 'Constructed based on aid agency' is 82% in GP Pande, it was calculated by number of answers (63) in that category divided by total sample collected (77) in GP Pande.

5. Long-term Evaluation of Participatory Approach for Housing Reconstruction (Results of Analysis)

Valid response used for this analysis is 493 from 6 communities. 118 respondents lost their family members because of earthquake or tsunami, and 348 responders had severe housing damage, 67 respondents had moderate damage and 41 responders had light damage. Only 6 responders did not get housing damage. 346 responders out of 493 live in same community over 20 years. At the recovery period, housing reconstruction was supported by aid organizations. In Ache, over 50% (GP Pande: 63 households, Lambung: 54 households) respondents rebuild their house by getting a support from aid organizations. On the other hand, in Yogyakarta and Padang, people appointed masons by themselves (Malese: 49 households, Serut: 60 households, Pasir Jambak: 67 households, Limpato: 75 households) and constructed a house by themselves (Malese: 48 households, Serut: 40 households, Pasir Jambak: 55 households, Limpato: 47 households). It shows that participatory approach for housing reconstruction was well practiced in Yogyakarta than other two areas (See Table 2). In Ache, people did not actively involved in reconstruction process. On the other hand, people in Yogyakarta and Padang participated in 'Purchasing materials' and 'Construction

of house', but only a few people participated to 'Community assessment', 'Land consolidation' and Community planning' (See Table 3).

Table 3. Participation for housing reconstruction process in each community (multiple answer)

	Ache		Yogyakarta		Padang		Total (n=493)
	GP Pande (n=77)	Lambung (n=93)	Mlese (n=72)	Serut (n=83)	Pasir Jambak (n=86)	Limpato (n=82)	
Reconstruction consultation / Attended donor explanation	14 (18%)	11 (12%)	15 (21%)	14 (17%)	1 (1%)	1 (1%)	56 (11%)
Selection of housing Reconstruction committee	1 (1%)	0 (0%)	20 (28%)	20 (28%)	1 (1%)	0 (0%)	42 (8.5%)
Selection of housing group	3 (4%)	2 (2%)	18 (25%)	27 (33%)	7 (8%)	1 (1%)	58 (12%)
Community assessment	1 (1%)	0 (0%)	10 (14%)	5 (6%)	4 (5%)	5 (6%)	25 (5.1%)
Land consolidation	5 (6%)	9 (10%)	6 (8%)	1 (1%)	5 (6%)	6 (7%)	32 (6.5%)
Community planning	1 (1%)	1 (1%)	13 (18%)	16 (19%)	0 (0%)	4 (5%)	35 (7.1%)
House design	2 (3%)	4 (4%)	32 (44%)	28 (34%)	7 (8%)	8 (10%)	81 (16%)
Purchasing materials	3 (4%)	6 (6%)	53 (74%)	35 (42%)	33 (38%)	30 (37%)	160 (32%)
Technical training	1 (1%)	0 (0%)	14 (19%)	10 (12%)	14 (16%)	6 (7%)	45 (9.1%)
Construction of house	4 (5%)	3 (3%)	45 (63%)	51 (61%)	45 (52%)	39 (48%)	187 (38%)
Quality control	6 (8%)	7 (8%)	33 (46%)	30 (36%)	17 (20%)	15 (18%)	108 (22%)
None	48 (62%)	54 (58%)	5 (7%)	10 (12%)	25 (29%)	22 (27%)	164 (33%)

5.1. Disaster awareness before/after natural disasters

IBM SPSS Statistics was used for analysis of variance and t-test that shows significant difference between disaster risk awareness previously and current disaster risk awareness ($t(492)=26.98$, $p<.001$). From this result and mean (Table 4), it shows that in comparison between previous and current disaster risk awareness, people's awareness increased after the disaster.

Table 4. Relation between participation for housing reconstruction and disaster risk awareness

disaster preparedness	frequency	mean	SD
Prepared for the natural disaster previously	493	0.06	0.41
Prepared for the natural disaster now	493	1.90	1.55

5.2. Participatory method and disaster risk awareness

The result of t-test shows significant differences between participation level and disaster risk awareness ($t(491)=8.29$, $p<.001$). From this result and mean (Table 5), it suggests that people with a higher participation score is also higher in disaster risk awareness.

Table 5. Relation between participation for housing reconstruction and disaster risk awareness

total items of preparation for next disasters	frequency	mean	SD
>=2 items	128	2.81	1.54
< 2 items	365	1.58	1.42

5.3. Participatory method and years of residence

The result of t-test, shows significant differences between participation level and years of residence ($t(401.96)=7.45$, $p<.001$). From this result and mean (Table 6), it suggests that people with a higher participation score lived in the same community longer.

Table 6. Relation between participation for housing reconstruction and years of residence

Years of residence	frequency	mean	SD
>=5 years	128	3.85	0.49
< 5 years	365	3.38	0.88

5.4. Participatory method and satisfaction with reconstructed house

The result of t-test, there is no significant differences between participation level and residence year ($t(460)=0.457$, $p>.01$). From this result and mean in Table 7, it was unable to define that there is a relation between participation level and satisfaction to reconstructed house.

Table 7. Relation between participation for housing reconstruction and satisfaction with recovery houses

satisfied with recovery house	frequency	mean	SD
Unsatisfied	144	2.22	1.76
Satisfied	318	2.13	2.03

6. Is Participatory Method Effective to Increasing People's Awareness for Disaster Preparedness?

In this study, we aim to evaluate effectiveness of participatory method for housing reconstruction and disaster awareness of participants about 10 years after the 'build back better' post-disaster reconstruction program. Through the questionnaire survey, it was clear that participation level in housing reconstruction process is related to years of residence and disaster risk awareness even though a long time has passed. People who lived in same community for a long time developed human networks within and outside of the community. Therefore they could access to information of recovery or acquire skills to adapt themselves to environmental changes of the community. Meanwhile, even though participatory method was used to involve the participants in the rebuilding their houses and was found to increase their disaster awareness, it was found that they were unsatisfied with their new houses. This suggests that there may be a need to provide more detailed explanation to convince participants so that they can be satisfied with outcome. This would require further interview survey to understand their situations in depth in the research.

Based on the findings from this study, it can be said that, for preparing or conducting housing reconstruction after natural disaster, participatory method is effective in increasing people's risk awareness which will remain in their lives. Therefore policy maker, aid organizations and government officers should clearly explain to participants of the reconstruction program; what kind of participatory method they plan, who the responsible person be, how program is evaluated, and how participatory method benefits them. It should not be top-down approach that aid organizations prepare every steps of participatory processes for participants, but instead, it should be a bottom-up approach that participants are able to acquire a necessary knowledge and skills to perform the activities on their own. Long-term observation is needed to evaluate the impact of these methods/approaches to the participant. In this study, we could show that participatory method was effective, however, in Ache, not many participants joined in reconstruction process, compared with other affected areas like Yogyakarta and Padang. In future study, we should also look into the different types and scales of disaster.

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